

Amendments to the Claims:

Re-write the claims as set forth below. This listing of claims will replace all prior versions and listings, of claims in the application:

Listing of Claims:

1. (Canceled)
2. (Canceled)
3. (Previously presented) A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:
 - calculating a power value for a first frame; and
 - adjusting a number of bits in a second frame based on the power value for the first frame.
4. (Previously presented) The method of claim 3 wherein the calculating the power value for the first frame further comprises:
 - calculating an average value of pixel values in each of a plurality of pixel blocks within the first frame;
 - for each of the plurality of pixel blocks, calculating a sum of absolute differences between the pixel values in the respective pixel block and the average value; and
 - adding each sum of the absolute differences for each of the plurality of pixel blocks within the first frame to obtain a power value for the first frame.
5. (Previously presented) A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:
 - calculating a reference global complexity for each I frame encoded;
 - calculating a reference power value for each I frame encoded;

calculating a power value for subsequent frames;

calculating a global complexity by multiplying the reference global complexity by the power value and dividing by the reference power value; and

using the global complexity to adjust a frame size.

6. (Withdrawn) A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

obtaining a prediction error frame including a plurality of pixel-level error values;

calculating a sum of absolute values of the pixel-level error values for a pixel block;

calculating an expected number of bits for the pixel block based on the sum of absolute values; and

using the expected number of bits for the pixel block to obtain constant-bit-rate video encoding.

7. (Withdrawn) The method of claim 6 wherein the using the expected number of bits for the pixel block to obtain constant-bit-rate video encoding further comprises:

calculating an expected number of bits for a frame in which the pixel block is located;

and

using the expected number of bits for the frame to obtain constant-bit-rate video encoding.

8. (Withdrawn) The method of claim 7 wherein the calculating the expected number of bits for the frame further comprises:

summing the expected number of bits for the pixel block for all pixel blocks in the frame.

9. (Canceled)

10. (Canceled)

11. (Withdrawn) A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

predicting a relationship between a quantizer scale factor and a number of encoded bits of a pixel block based on a known relationship in previous pixel blocks of a same type; and
using the quantizer scale factor to control a pixel block level rate of the video encoder.

12. (Withdrawn) The method of claim 11 wherein the using the quantizer scale factor to control the pixel block level rate of the video encoder further comprises:

using the quantizer scale factor together with a sum of absolute values of pixel-level error values to control the pixel block level rate of the video encoder.

13. (Withdrawn) The method of claim 11 wherein the predicting the relationship between the quantizer scale factor and the number of encoded bits of the pixel block further comprises:

predicting a first relationship between the quantizer scale factor and a first number of encoded bits of a first type of pixel block based on a first known relationship in previous pixel blocks of the first type; and

predicting a second relationship between the quantizer scale factor and a second number of encoded bits of a second type of pixel block based on a second known relationship in previous pixel blocks of the second type.

14. (Withdrawn) A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

calculating a prediction for a number of bits encoded for a pixel block based on a sum of absolute values of pixel-level error values, a pixel block complexity, and a quantizer scale factor;
and

using the prediction for adjusting the quantizer scale factor to meet a targeted picture-level number of bits.

15. (Withdrawn) A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

calculating a group-of-pictures-level prediction for a number of bits encoded for a group of pictures;

calculating a picture-level prediction for a number of bits encoded for a picture;

calculating a pixel-block-level prediction for a number of bits encoded for a pixel block;

and

using the group-of-pictures-level prediction, the picture-level prediction, and the pixel-block-level prediction to adjust a quantizer scale factor to provide the rate control for the video encoder.

16. (Withdrawn) The method of claim 15 wherein the calculating the picture-level prediction for the number of bits encoded for the picture further comprises:

calculating the picture-level prediction for the number of bits encoded for the picture based on a pixel block type, a sum of absolute values of pixel-level error values, and a pixel block complexity.

17. (Withdrawn) The method of claim 15 wherein the calculating the pixel-block-level prediction for the number of bits encoded for the pixel block further comprises:

calculating the pixel-block-level prediction for the number of bits encoded for the pixel block based on a local activity value.

18. (Withdrawn) The method of claim 15 wherein the calculating the group-of-pictures-level prediction for the number of bits encoded for the group of pictures further comprises:

calculating the group of pictures level prediction for the number of bits encoded for the group-of-pictures based on a global complexity value.

19. (Previously presented) A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

obtaining a scene change indication from a prediction error image;

using the scene change indication to reset a global complexity history; and

using the global complexity history to provide the rate control for the video encoder.

20. (Previously presented) The method of claim 19 wherein the obtaining the scene change indication from the prediction error image further comprises:

counting a first number of intra-coded pixel block in the prediction error image;

counting a second number of non-intra-coded pixel block in the prediction error image;

calculating a ratio of the first number and the second number;

comparing the ratio to a threshold to determine a result; and

using the result as the scene change indication.

21. (Currently amended) Apparatus for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

a preprocessing stage for determining a power value; and

a group-of-pictures-level rate control block operatively coupled to the preprocessing stage to receive the power value and to provide a target quantizer step size used to provide rate control for the video encoder;

wherein the group-of-pictures-level rate control block causes an adjustment of sizes of non-intra frames based on expected sizes of future intra frames.

22. (Original) The apparatus of claim 21 wherein the preprocessing stage updates the power value for each subsequent picture being encoded.

23. (Canceled)

24. (Previously presented) Apparatus for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

a prediction error image block to determine L1 distances according to sums of absolute differences; and

a picture-level rate control block operatively coupled to the prediction error image block to receive the L1 distances and to produce a target quantizer step size for a pixel block.

25. (Previously presented) The apparatus of claim 24 further comprising:

a complexity estimator block operatively coupled to the prediction error image block to determine non-intra pixel block complexity values and intra pixel block complexity values.

26. (Canceled)

27. (Previously presented) Apparatus for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

a prediction error image block to determine L1 distances according to sums of absolute differences;

a complexity estimator block coupled to the prediction error image block to determine non-intra pixel block complexity values and intra pixel block complexity values; and

a number-of-bit predictor operatively coupled to the prediction error image block to receive the L1 distances and to the complexity estimator block to receive the non-intra pixel block complexity values and the intra pixel block complexity values, the number-of-bit predictor to predict a number of bits generated by the video encoder.

28. (Canceled)

29. (Canceled)

30. (Previously presented) A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

obtaining a prediction error frame including a plurality of pixel-level error values;

calculating a sum of absolute values of the pixel-level error values for a pixel block of the frame;

calculating an expected number of bits for each pixel block in the frame by multiplying a pixel block complexity value for the pixel block by the sum of the absolute values of the pixel-level error values for the pixel block and dividing by a target quantizer step size for the frame;

using the calculated expected number of bits for each pixel block located in the frame to calculate an expected number of bits for the frame; and

using the expected number of bits for the frame to obtain constant-bit-rate video encoding.

31. (Previously presented) The method of claim 30 wherein the calculating the expected number of bits for the frame further comprises:

summing the expected number of bits for each pixel block in the frame.

32. (Previously presented) Apparatus for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

a prediction error image block to determine L1 distances according to sums of absolute differences;

a picture-level rate control block operatively coupled to the prediction error image block to receive the L1 distances and to produce a target quantizer step size for a pixel block; and

a complexity estimator block operatively coupled to the prediction error image block to determine non-intra pixel block complexity values and intra pixel block complexity values,

wherein the prediction error image block determines a scene change and provides a scene change indication to the complexity estimator block, the complexity estimator block resetting a global complexity value upon receipt of the scene change indication.

33. (New) A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

obtaining a prediction error frame including a plurality of pixel-level error values and L1 distances;

calculating a power value for a first frame;

calculating a global complexity and pixel block complexities based in part on the obtained prediction error frame;

using the power value and the global complexity to obtain a group-of-pictures-level rate control;

using the L1 distances, the pixel block complexities, the group-of-pictures-level rate control, and a pixel block type to obtain a picture-level rate control; and

using a group-of-pictures-level prediction for a number of bits encoded for a group-of-pictures, a picture-level prediction for a number of bits encoded for a picture, a pixel-block-level prediction for a number of bits encoded for a pixel block, the L1 distances and the picture-level rate control to obtain a pixel-block-level rate control for the video encoder.